**Simulation Report 2**

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**Codes for data processing:**

<https://github.com/yifuhhh/EE396V_TFT/blob/master/DataProcess/Project_2.py>

**Script for one of the bulk trap sweeps:**

<https://github.com/yifuhhh/EE396V_TFT/blob/master/Prj_2/prg_2_bulkshallow/TFT_bulkshallow.in>

**Script for channel length sweep:**

<https://github.com/yifuhhh/EE396V_TFT/blob/master/Prj_2/prg_4_channel/TFT_channel.in>

**Section I**

1. **Interface trap peak density**

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Figure 1.1 Trap density of states for sweep of interface trap

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Figure 1.2 Transfer curve for sweep of interface trap, linear scale

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Figure 1.3 Transfer curve for sweep of interface trap, log scale

From Fig 1.2 and 1.3, it is observed that when the density of acceptor-like states in the tail distribution at the conduction band edge in interface increases, Id would decrease at the same Vgs.

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Figure 1.4 Threshold voltage for sweep of interface trap

From Figure 1.4, it is observed that Vth increases as the density of acceptor-like states in the tail distribution at the conduction band edge in interface increases.

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Figure 1.5 Subthreshold swing for sweep of interface trap

From Figure 1.5, it is observed that subthreshold swing decreases as the density of acceptor-like states in the tail distribution at the conduction band edge in interface increases.

1. **Bulk shallow trap peak density**

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Figure 2.1 Trap density of states for sweep of bulk shallow trap

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Figure 2.2 Transfer curve for sweep of bulk shallow trap, linear scale

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Figure 2.3 Transfer curve for sweep of bulk shallow trap, log scale

From Fig 2.2 and 2.3, it is observed that when the density of acceptor-like and donor-like states in the tail distribution at the conduction band edge in shallow bulk increases, Id would decrease at the same Vgs when Vgs > 0.

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Figure 2.4 Threshold voltage for sweep of bulk shallow trap

From Figure 2.4, it is observed that Vth gets maximum at NTA & NTD = 2e21 cm-3/eV. However, it is not consistent with the trend in Figure 2.2. The main reason for this phenomenon is that in our simulation, Vgs goes up to 20 V. To fully describe the transfer performance especially when NTA & NTD = 8e21 cm-3/eV, Vgs has to increase more.

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Figure 2.5 Subthreshold swing for sweep of bulk shallow trap

From Figure 2.5, it is observed that subthreshold swing (absolute value) gets minimum at NTA & NTD = 2e21 cm-3/eV.

1. **Bulk deep trap peak density**

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Figure 3.1 Trap density of states for sweep of bulk deep trap

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Figure 3.2 Transfer curve for sweep of bulk deep trap, linear scale

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Figure 3.3 Transfer curve for sweep of bulk deep trap, log scale

From Fig 3.2 and 3.3, it is observed that when total density of donor-like states in a Gaussian distribution in the deep bulk increases, Id would not be affected a lot when Vgs > 0 and Id would decrease as NGD increases when Vgs < 0.

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Figure 3.4 Threshold voltage for sweep of bulk deep trap

From Figure 3.4, it is observed that Vth decreases as NGD increases.

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Figure 3.5 Subthreshold swing for sweep of bulk deep trap

From Figure 3.5, it is observed that subthreshold swing (absolute value) gets minimum at NGD = 2e16 cm-3/eV.

**Section II**

1. Channel length

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Figure 4.1 Transfer curve for sweep of channel length, linear scale

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Figure 4.2 Transfer curve for sweep of channel length, log scale

From Fig 4.1 and 4.2, it is observed that when channel length increases, Id would decrease at the same Vgs > 0.

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Figure 4.3 Threshold voltage for sweep of channel length

From Figure 4.3, it is observed that Vth increases as channel length increases.

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Figure 4.4 Subthreshold swing for sweep of channel length

From Figure 4.4, it is observed that subthreshold swing (absolute value) gets minimum at channel length = 30 um.